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Transitioning from cigarettes to electronic cigarettes increases alcohol consumption

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Abstract

Objective—Electronic cigarettes (e-cigs) are a nicotine delivery device that have recently been linked to alcohol use. Many individuals that smoke cigarettes transition to e-cigs as an alternative to cigarette use, despite potential negative health effects of e-cigs. No research to date has examined how former smokers that have transitioned to e-cigs differ from former smokers that do not use e-cigs, particularly in relation to alcohol use. Further, no research has examined how former smokers that use e-cigs regularly or socially may differ in alcohol consumption.

Method—Using an online community dwelling sample (Former smokers N=198, mean age=34.70, SD=11.45, 56.1% female, 78.3% Caucasian, 37.9% e-cig users), the present study assessed smoking status and alcohol use, with the latter assessed using a Timeline Followback calendar and the Alcohol Use Disorder Identification Test (AUDIT).

Results—In all former smokers, total drinks (b=4.01, p=0.02) and average drinks per drinking day (b=0.61, p=.01) were both related to e-cig use status, with e-cig users reporting higher alcohol consumption. Among e-cig using former smokers, social users, but not regular users, showed positive relationships with AUDIT scores, b=1.90, p=.02, total drinks, b=9.12, p<.001, average drinks, b=0.98, p=.006, and hazardous drinking status, OR=3.21, p=.01.

Conclusions—Findings suggest that: (1) former smokers who use e-cigs may have a potential for higher alcohol use; and (2) those who use e-cigs socially may be at heightened risk for hazardous patterns of alcohol consumption. This should be taken into consideration by healthcare providers.

Introduction

Electronic-cigarettes (e-cigs), a form of nicotine delivery, are growing in popularity in the United States, with 12.6% of adults reporting ever-use and 3.6% reporting daily use (Schoenborn & Gindi, 2014). Interestingly, the e-cig use prevalence rate among individuals with substance use disorders (SUDs) is 17% (Peters et al., 2015) and over 50% of these individuals endorse using e-cigs for smoking cessation (Peters et al., 2015). Similar to

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cigarettes, e-cigs are related to problematic alcohol use (Hershberger, et al., 2016), past 30-day binge drinking (Saddleson et al., 2015), and daily alcohol consumption (Cohn, et al., 2015); as such, this could be particularly worrisome for those with a SUD. In particular, social e-cig users (less frequent users) have higher alcohol use than regular e-cig users (more frequent users); relatedly, this effect has also been shown for those that use both cigarettes and e-cigs ("dual users"; d=0.35; Hershberger, et al., 2016). Thus, alcohol use patterns have been examined in social, regular, and dual e-cig users. However, there are additional characteristics of e-cig users that could be differentially related to alcohol use, such as being a former cigarette smoker.

Although an association has been found between varying types of e-cig use and alcohol use (Cohn, et al., 2015; Hershberger, et al, 2016; Saddleson, et al., 2015), no research has investigated the relationship between alcohol use and e-cig use in former smokers that have transitioned to e-cigs, especially as compared to former smokers not using e-cigs. Such research would help inform e-cig use for smoking cessation; of note, if alcohol use is found to be higher in former smokers that have transitioned to e-cigs, e-cigs could be inadvertently increasing or perpetuating alcohol use and may not be an ideal tool for smoking cessation. Further, if former smokers that transitioned to e-cigs show higher alcohol use, this would provide initial support that e-cigs may have a similar relationship to alcohol as cigarettes, and may easily replace cigarettes as a cue for alcohol. Additionally, no research has examined how social versus regular e-cig use in the former smoker population may be differentially related to alcohol use. Such findings would help inform substance use treatment, aid in identifying those that may be at heightened risk for continued substance use, and call for clinicians to carefully consider the consequences of e-cig use in this population.

The present study aimed to: (1) examine alcohol use among former smokers that either do or do not currently use an e-cig; and (2) examine alcohol use rates among former cigarette smokers that now use e-cigs socially and regularly. Particularly, we hypothesized that: (1) former smokers that now use e-cigs would report greater alcohol use, compared to former smokers who do not use e-cigs; and (2) former smokers that use e-cigs socially would report greater alcohol use than those that use e-cig regularly.

Method

Participants

Of an initial 652 participants (inclusion criteria: 21 years or older, able to read and understand questions in English, live in the United States, and drink alcohol), a total of 198 participants reported being former smokers (mean age=34.70, SD=11.45, 56.1% female, 78.3% Caucasian, 37.9% e-cig users; see Table 1). Following Institutional Review Board approval, participants signed up to participate online through Amazon's Mechanical Turk (www.mturk.com; MTurk), an online service that connects researchers with individuals who complete tasks for a wage. The MTurk subject pool has been used to research addiction (Boynton & Richman, 2014), personality (Holden, et al., 2013), relationships (Adams, et al., 2014), self-injury (Andover, 2014) and grief (Papa, et al., 2014). MTurk samples have shown good test-retest reliability, with less than two percent showing inconsistent responses across

one week (Shapiro, et al., 2013).[1] The classification of *Former Smoker now e-cig user* was given to participants who endorsed that they used to smoke cigarettes and currently use an e-cig. The classification of *Social User* was given to those Former Smoker now e-cig users reporting social e-cig use only. The classification of *Regular User* was given to those Former Smoker now e-cig users reporting regular e-cig use only.

Measures

E-cig and Cigarette Use—Participants responded to a one e-cig use item ("Do you use electronic-cigarettes currently."). This item had three response options: "No", "Yes, I use e-cigarettes regularly [daily]", and "Yes, I use e-cigarettes, in social contexts only." Participants also responded to one cigarette use item ("Have you ever been a cigarette smoker?"). This item had four response options: "No", "Yes, I smoke cigarettes regularly [daily]", "Yes, I smoke cigarettes, in social contexts only", "Yes, I used to smoke cigarettes." Measures of social versus regular use have been validated as a proxy for e-cig use frequency, and have been shown to differentially predict alcohol use (Hershberger et al., 2016).

E-cig use frequency was assessed using one item ("How often do you use an electronic-cigarette?"). This item had four response options: "A few times a month," "A few times a week," "A few times a day", and "At least ten times per day." This item has previously been shown to correspond with social versus regular use, with social users reporting less frequent e-cig use than regular users (Hershberger, et al., 2016). Participants were also asked how long they had been using e-cigs ("When did you start using an electronic cigarette? Please give your best estimate"). Participants reported the month and year in which they started using an e-cig, which was subtracted from July 2015 to create the continuous variable *length of use*.

Reason for E-cig Use—Participants responded to one item assessing reason for using an e-cig ("Please rate each option from 1-Most important reason for using an e-cigarette, to 7-Least important reason for using an e-cigarette). Response options were: to quit smoking cigarettes, because they are less expensive than cigarettes, for your own health, for the health of others, to reduce cravings for cigarettes, to reduce nicotine withdrawal, to use where smoking is banned, and other (adapted from Etter & Bullen, 2011). Participants could choose more than one option per rating (e.g. two number one reasons for using an e-cig).

Alcohol Use

AUDIT—The Alcohol Use Disorders Identification Test (AUDIT; Saunders, et al., 1993) is a ten-item scale that assesses hazardous alcohol consumption, abnormal alcohol consumption behavior, and alcohol related problems. Data obtained by the AUDIT allows for discriminating between hazardous and non-hazardous drinkers (Saunders, et al., 1993), with AUDIT responses showing concurrent validity with other measures of alcohol use (Donovan, et al., 2006). The AUDIT demonstrated acceptable reliability in the current sample (α=0.75). A total AUDIT score was created by summing the ten items on the scale.

[1]The data for the current study was taken from a larger sample reported in Hershberger, et al (2016) combined with novel data not previously reported.

The Timeline Follow-Back—(TLFB; Sobell & Sobell, 1992) aids participants in estimating daily alcohol consumption. Participants were asked to indicate the number of drinks they consumed each day over a two-week period. Responses on the TLFB have adequate test-retest reliability for days abstinent from alcohol, days with alcohol consumption without a binge episode, and days with binge episodes in social drinkers (Sobell & Sobell, 1992). The TLFB also demonstrated high convergent validity with the Addiction Severity Index (DeMarce, et al., 2007). Total number of drinks was calculated by summing the total number of drinks each individual consumed over the two-week period. Average number of drinks per drinking day was calculated by dividing the sum of the total number of drinks consumed over the two-week period by the total number of alcohol consumption days. Hazardous drinking status was assessed using NIAAA guidelines of 7 drinks per week for women and 14 drinks per week for men (NIAAA, 2015), with participants being categorized as either Hazardous or Non-Hazardous drinkers.

Careless Responding—As suggested by Meade & Craig (2012), careless responding was assessed by the use of four "bogus items" ("I have never brushed my teeth," "I do not understand a word of English," "I sleep less than one hour per night," and "I have been to every country in the world"). These items were placed randomly throughout the test: one proceeding the TLFB, one preceding the AUDIT, and two proceeding a measure unrelated to the present study. Response options for these items ranged from 1 (agree strongly) to 7 (disagree strongly) scale. It was determined a priori that answering a 1 or 2 on two or more bogus items would result in that participant's data being removed for study analyses.

Procedure—Workers on Amazon's Mechanical Turk self-selected to take part in this online study, which was listed as "E-cig, Cigarette, and Alcohol Use Study." Participants were given a link to the survey location, where inclusion criteria were reassessed; of note, only those who met inclusion completed study measures. Participants who completed the study received $0.75 in compensation (average completion time=12.23 minutes), which is in line with the average MTurk hourly wage of $1.40 (Horton et al., 2010). Former smokers who failed two or more bogus items were removed from all analyses (N=10). Less than 0.01% of AUDIT data were missing at random; therefore, data were imputed through linear interpolation, which produces less biased results compared to other imputation techniques (Little & Ruben, 2002).

Results

Preliminary Analyses

Within all former smokers (N=198), AUDIT scores ranged from 1 to 22 (mean=6.07, SD=4.17) and were slightly skewed (skewness=1.58, kurtosis=2.89); however, data transformation did not improve the distribution of scores in a meaningful way. Total drinks ranged from 0 to 56 (mean=13.82, SD=10.90) and were approximately normally distributed (skewness=1.18, kurtosis=1.11). Average drinks ranged from 0 to 9 (mean=2.70, SD=1.73) and were approximately normally distributed (skewness=1.54, kurtosis=0.38). As assessed via the TLFB, a total of 33 individuals were classified as hazardous drinkers as assessed via

the TLFB. Hazardous and non-hazardous drinkers did not differ significantly by gender (χ^2=1.67, p=0.24), ethnicity (χ^2=5.21, p=0.27), or age (t(166)=−1.81, p=0.07).

Within former smokers who are now e-cig users, 30 reported social use and 45 reported regular use. Social users and regular users did not differ significantly by gender (χ^2=2.31, p=0.81), ethnicity (χ^2=1.85, p=0.76), or age (t(73)=1.01, p=0.31). All former smoker e-cig users reported using e-cigs for an average of 17.47 (SD=13.29) months. Length of e-cig use did not differ significantly by regular e-cig use (mean=17.30, SD=14.03) and social e-cig use (mean=15.59, SD=12.80), t(74)=−0.09, p=.93. Top reasons for e-cig use were to quit smoking (63.6%), for one's own health (45.3%), and to reduce craving for nicotine (30.6%). Compared to social users, significantly more regular users endorsed using e-cigs to quit smoking, χ^2=13.23, p=.04. Compared to regular users, social users endorsed using e-cigs to circumvent smoking bans, χ^2=14.61, p=.04 (see Table 2). Compared to regular users, social users reported less frequent e-cig use, χ^2=60.98, p<.001 (see Figure 1).

AUDIT scores were moderately and significantly correlated with total drinks (r=0.67, p<.001), average drinks (r=0.55, p<.001), and hazardous drinking status (r=0.37; p <.001). Average drinks were significantly associated with hazardous drinking status (r=0.44; p<.001), and total drinks (r=0.54; p<.001); of note, these moderate correlations demonstrate that these are separate, but related constructs of alcohol use. Length of e-cig use was not significantly associated with any alcohol use variables (all r's=−0.12 to 0.06, all p's=0.31 to 0.85).

E-cig use Effects on Alcohol Use among Former Smokers

Hierarchical linear regression analyses (see Table 3) were conducted to examine the effect of current e-cig use on AUDIT, total drinks, and average drinks in three separate analyses. There were two steps for each analysis: (1) we controlled for age, ethnicity (1-White, 0-Non-White, due to limited participants with non-White ethnicity), and gender at step 1; and (2) we entered e-cig use status at step 2 (dummy coded 0-former smoker only, 1-former smoker now e-cig user). AUDIT scores were not significantly related to e-cig use status, b=0.99, p=.09. Total drinks across fourteen days (b=4.01, p=0.02) and average drinks per drinking day (b=0.61, p=.01) were both related to e-cig use status, with e-cig users reporting higher consumption. After controlling for multiple comparisons using a stepwise Holm-Bonferonni method (Holm, 1979), average drinks remained significantly related to e-cig use status.

Social and Regular E-cig Use Effects on Alcohol Use

Three separate hierarchical linear regression analyses (see Table 4) were conducted to examine the effect of e-cig use status type (non-user, social user, and regular user) on AUDIT, total drinks, and average drinks. Two steps were entered in each analysis: (1) we controlled for age, ethnicity (1-White, 0-Non-White), and gender at step 1; and (2) we entered e-cig use status type at step 2 (dummy coded 0-non-users as the reference group). AUDIT scores were significantly related to social e-cig use (b=1.90, p=.02), with social users reporting higher AUDIT scores compared to non-users, but not related to regular use (b=0.43, p=.53). Total drinks were significantly related to social e-cig use (b=9.12, p<.001),

with social users reporting more total drinks than non-users, but not related to regular use (*b*=0.81, *p*=.69). Average drinks was significantly related to social e-cig use (*b*=0.98, *p*=.006), with social users reporting more average drinks than non-users, but not related to regular use (*b*=0.38, *p*=.20). After controlling for multiple comparisons (Holm, 1979), total drinks and average drinks remained significantly related to social e-cig use.

Hazardous Drinking and E-cig use

Hierarchical logistic regression analyses (Table 5) were used to examine the relationship between hazardous drinker status (0 non-hazardous drinker and 1 hazardous drinker) and e-cig status in two separate analyses. Age, ethnicity (1-White, 0-Non-White), and gender were entered at step 1. First, e-cig status (no e-cig use, current e-cig user) was entered at step 2. Hazardous drinker status was not significantly related to e-cig use among former smokers (OR=1.48, *p*=.32). Second, e-cig status type (social e-cig use, regular e-cig use, with non-users as the reference group), was entered at step 2. Social e-cig use was significantly related to hazardous drinker status (OR=3.21, *p*=.01), indicating a higher likelihood of being a hazardous drinker for social e-cig users compared to non-users, but not higher likelihood in regular users as compared to non-users (OR=0.69, *p*=.50). After controlling for multiple comparisons (Holm, 1979), hazardous drinking remained significantly related to social e-cig use.

Discussion

Although previous work has suggested a relationship between alcohol use and e-cig use (Cohn, et al., 2015; Hershberger, et al., in press; Saddleson, et al, 2015), the majority of this work has not considered how transitioning from smoking cigarettes to using e-cigs might affect alcohol consumption. Compared to former smokers not using an e-cig, we found that former smokers that have switched to e-cigs, the majority of which endorse doing so to quit smoking, display a pattern of higher problematic alcohol use, consume more drinks across a two-week period, and consume more alcohol per drinking occasion. Further, those that use e-cigs socially display a pattern for higher problematic alcohol use, consume more drinks across two-weeks and within one drinking occasion, and are more often classified as a hazardous drinker; in contrast, these patterns were not present for regular e-cig users.

E-cigs are commonly used as a non-prescribed smoking cessation device in substance using populations (Peters, et al., 2015); however, given the relationship between e-cig use and alcohol use, e-cig use for smoking cessation in such populations is likely problematic. This is the first study to examine alcohol use among former smokers who have or have not transitioned to e-cig use; as such, this work has potentially important implications for the use of e-cig for smoking cessation. Regardless of the reason for the transition, the present findings indicate that transitioning from cigarettes to e-cigs might increase or perpetuate alcohol use rather than decrease it. Given high rates of alcohol use among smokers, this transition can be considered a rather important risk factor (e.g. McKee, et al., 2007). This thus necessitates research targeting individuals transitioning from cigarettes to e-cigs to examine changes in alcohol use behaviors.

In replication of other studies (e.g. Etter & Bullen, 2011), the majority of participants endorsed using e-cigs to quit smoking or to improve their health, which we found was particularly prominent in regular e-cig users. Such endorsements may be problematic, as e-cigs have been shown to have negative health effects in the short term (e.g. Schweitzer, et al., 2015; Sussan, et al., 2015; Lerner, et al. 2015) and using e-cigs to improve health is based on unfounded claims. Additionally, although research has shown that e-cigs may result in decreased smoking, there is little evidence showing that e-cigs are any more effective than approved and well-studied forms of smoking cessation, such as nicotine replacement therapy (McRobbie, et al., 2014; Rahman, et al., 2015).

As former smokers appear likely to be using e-cigs for smoking cessation, it is important to next consider what typical outcomes one would expect from using e-cigs for cessation. Most saliently, there should be a reduction and ultimate cessation of cigarette use. Additionally, and most relevant to the present study there is a bidirectional reduction in cigarette use and alcohol use in cessation treatment. (e.g. Kahler, et al, 2008; Kalman, et al, 2010; Lisha, et al., 2014; Cooney, et al., 2015). For example, 41.5% of individuals endorse consuming alcohol prior to smoking lapse (Kahler, et al., 2010). Drinking relapse episodes have been shown to be predicted by a prior high urge to smoke (Cooney, et al., 2007) and lower confidence in resisting urge to smoke (Holt, et al., 2011). As in other smoking cessation treatments (e.g. combined nicotine patch and gum; Cooney, et al, 2009), if e-cigs were to be an effective means of smoking cessation, individuals would show similar improvement in their alcohol consumption in addition to reduced cigarette use. Although the present study did not assess this directly, healthcare providers should critically examine the potential costs of e-cig use, particularly among former smokers or those looking to cease smoking, as it could increase risk for hazardous alcohol use.

These findings provide further support for a program of research suggesting that e-cig use have a similar relationship to alcohol as do cigarettes (e.g., Hershberger, et al., 2016; Hershberger, et al., under review). This effect is especially prominent among social e-cig users, likely because social e-cig users might use e-cigs primarily in the context of alcohol use or cues (e.g. at the bar, at a friend's home drinking) as compared to regular use, which could be less likely to occur in the context of alcohol cues (e.g. the inclusion of work, the car). Through social e-cig use, processes such as mutual craving, expectancies, and classically conditioned processes (pairing of alcohol and e-cigs) are likely to occur, and thus increase mutual use. Though not assessed in the present study, future work should examine the setting in which individuals report e-cig use and the presence of potential alcohol triggers in predicting alcohol use in e-cig users.

Though the present study makes a novel contribution in understanding the potential negative consequences e-cigs may have for alcohol use among former smokers, there are some limitations to discuss. First, though the present study included "bogus items", validity of online survey data can be questionable. "Bogus items" were included between the scales and used a different response scale, which may have drawn participant's attention to them, thus underestimating the amount of random responders. However, it is important to note that all individuals that failed the "bogus items" were missing more than 75% of their data, which occurred towards the end of the survey; as such, it was likely these individuals began, but did

not complete the study rather than answering invalidly. Second, participants self-selected to take part in the survey, thus individuals who used e-cigs, cigarettes, and alcohol were more likely to participate, and could have biased study findings; for instance, these individuals may have stronger opinions about the topics. Third, e-cig use was assessed through single items, which asked participants to report either social or regular e-cig use. The relationships between e-cig use and alcohol use might differ if e-cig use was measured as a continuum (e.g., amount used in a week) rather than a dichotomy. Past studies have characterized e-cig use based on past 30-day use (Pokhrel, et al., 2014), but single face-valid items have also been validated (Hershberger, et al., 2016). Also, the present sample contained 75 e-cig users, which is relatively small; as such, future studies should replicate findings in a larger sample. Additionally, due to the cross-sectional nature of the study, the direction of the effects observed cannot be established. It is possible that those former smokers that transitioned to e-cig use also had another characteristic that made them likely to consume more alcohol (e.g. personality, psychological disorder) or other confounding factors not assessed in the present study. For example, biological factors (e.g., dopaminergic processes and genetic predispositions for substance use) are plausible contributors to concurrent e-cig and alcohol use in former smokers. Elucidating mechanisms that aid in predicting who will have the fewest gains from transitioning to e-cigs is crucial to advancing the understanding of e-cigs for smoking cessation. In order to describe the behavioral trajectory of transitioning to e-cigs, it is also important to examine changes in alcohol use following the transition from cigarettes to e-cigs, which was beyond the scope of the present study.

Despite some potential limitations, the present findings have important public health and clinical implications in regards to e-cig use for smoking cessation. The present research suggests that former smokers who use e-cigs may have a higher potential for patterns of problematic alcohol use and that those who use e-cigs socially may be at heightened risk for hazardous patterns of alcohol consumption. Further, this effect could generalize to other substances of abuse (e.g. marijuana). Clinicians and other treatment providers, particularly those administering substance use related treatments, should likely advice against the use of e-cigs for smoking cessation, as they may cause undo harm by increasing alcohol or other substance use in an already vulnerable population.

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Glossary

Amazon's Mechanical Turk
A web-service that connects researchers to individuals willing to complete a task for a wage.

Electronic cigarettes (e-cigs)
A form of nicotine delivery that heats a nicotine containing liquid, vaporizes the liquid and is inhaled and exhaled by the user, similar to a cigarette.

Former smokers
Individuals that formerly smoked cigarettes and have now discontinued use.

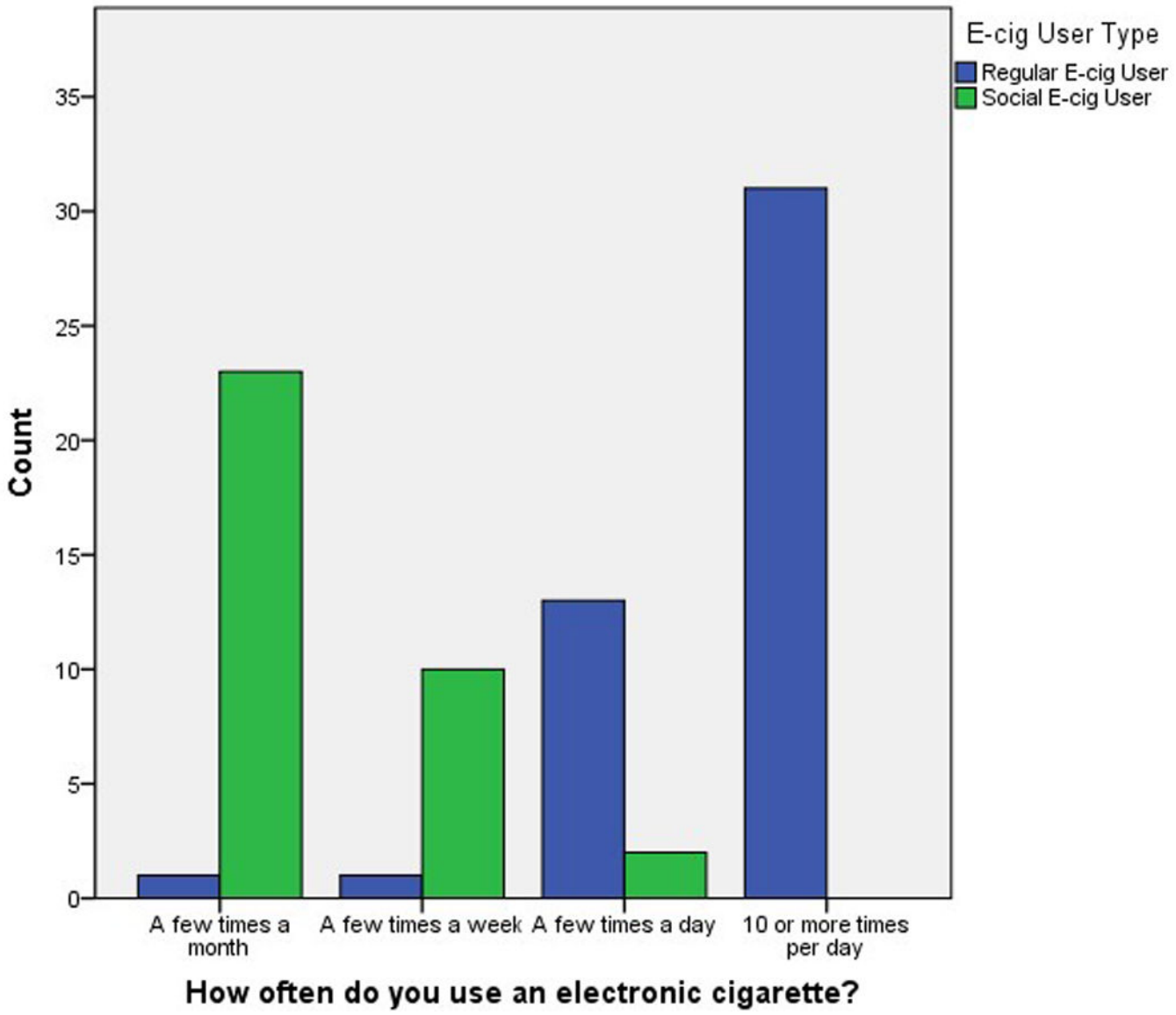

Figure 1.
E-cig use frequency by social and regular e-cig users. $\chi 2=60.98$, $p<.001$

Table 1

Demographics and study variables by e-cig use

Variable	Former Smoker	Former Smoker E-cig user
Age Mean (SD)	36.39 (12.42)[a]	31.93(9.07)[a]
Male	57	30
Female	66	45
Caucasian	96	59
African American	8	4
Asian	3	2
Hispanic	15	8
American Indian	-	1
Other	1	1
Social E-cig User	-	30
Regular E-cig User	-	45
AUDIT Mean (SD)	5.57 (3.51)[b]	6.83 (4.91)[b]
Average Drinks Mean (SD)	2.46 (1.50)[c]	3.19 (2.13)[c]
Total Drinks Mean (SD)	12.60 (10.82)[d]	16.60 (13.22)[d]
Hazardous Drinker	17	16

Note. Independent sample t-tests comparing former smokers and former smokers, now e-cig users:

[a] $t(196)=2.70$, $p=.008$,

[b] $t(196)=-2.09$, $p=.04$,

[c] $t(196)=-2.78$, $p=.006$,

[d] $t(196)=-2.32$, $p=.02$

Table 2

Former smoker e-cig users' reasons for e-cig use.

Reason Number	1		2		3	
Reasons	**Regular E-cig User**	**Social E-cig User**	**Regular E-cig User**	**Social E-cig User**	**Regular E-cig User**	**Social E-cig User**
Quit Smoking[a]	45%	18.6%	6%	4%	4%	2.6%
Less Expensive	13.30%	8%	22.6%	5.3%	10.7%	9.3%
Own Health	28%	17.30%	8%	5.3%	16%	4%
Others Health	16%	9.30%	10.7%	10.7%	14.7%	5.3%
Reduce Craving	22.60%	8%	12%	6.7%	5.3%	2.7%
Reduce Withdrawal	17.30%	8%	9.3%	5.3%	6.7%	4%
Use where smoking is banned[b]	4%	9.3%	8%	4%	6.7%	12%

Note. Participants could choose more than one option for each ranking of reason for e-cig use. Chi-square tests of independence were conducted for each potential reason for use by regular versus social e-cig user:

[a] χ^2=13.23, p=.04,

[b] χ^2=14.61, p=.04.

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Table 3

Hierarchical linear regression examining the relationship between former smoker either using or not using an e-cig and alcohol use.

	b	*B*	*t*	*p*	95% CI *b* Lower	95% CI *b* Upper	ΔR^2	*p*
AUDIT								
Step 1							0.13	<.001
White	−0.09	−0.25	−3.61	<.001	−0.14	−0.04		
Gender	−1.68	−0.20	−2.98	.003	−2.79	−0.57		
Age	−0.74	−0.07	−1.09	.28	−2.08	0.60		
Step 2							0.01	0.09
Former smoker E-cig user	1.00	0.12	1.71	.09	−0.16	2.15		
Total Drinks								
Step 1							0.07	0.07
White	−0.07	−0.07	−0.91	.37	−0.22	0.08		
Gender	−4.42	−0.18	−2.61	.01	−7.76	−1.09		
Age	−0.14	−0.01	−0.07	.95	−4.15	3.87		
Step 2							0.03	0.02
Former smoker E-cig user	4.01	0.16	2.29	.02	0.55	7.46		
Average Drinks								
Step 1							0.12	0.00
White	−0.04	−0.23	−3.36	.001	−0.06	−0.02		
Gender	−0.78	−0.21	−3.19	.002	−1.26	−0.30		
Age	0.11	0.03	0.39	.70	−0.47	0.69		
Step 2							0.03	0.02
Former smoker E-cig user	0.61	0.17	2.43	**.01**	0.12	1.11		

Note. Non e-cig users are the reference group. Bolded p-values are significant after correcting for multiple comparisons (Holm, 1979).

Table 4

Hierarchical linear regression examining the relationship between former smoker either using an e-cig socially, regularly or not using an e-cig and alcohol use.

	b	*B*	*t*	*p*	95% CI *b* Lower	95% CI *b* Upper	ΔR^2	*p*
AUDIT								
Step 1								
White	−0.09	−0.24	−3.52	.001	−0.14	−0.04		
Age	−1.71	−0.21	−3.03	.003	−2.81	−0.60		
Gender	−0.64	−0.06	−0.95	.34	−1.98	0.69		
Step 2							0.02	0.07
Social E-cig	1.90	0.16	2.34	.02	0.30	3.51		
Regular E-cig	.43	0.04	0.63	.53	−0.92	1.78		
Total Drinks								
Step 1								
White	−0.05	−0.05	−0.74	.46	−0.20	0.09		
Age	−4.56	−0.19	−2.75	.006	−7.83	−1.29		
Gender	0.40	0.01	0.20	.84	−3.54	4.34		
Step 2							0.07	0.002
Social E-cig	9.12	0.27	3.80	<.001	4.38	13.86		
Regular E-cig	0.81	0.03	0.40	.69	−3.16	4.78		
Average Drinks								
Step 1								
White	−0.04	−0.22	−3.27	.001	−0.06	−0.01		
Age	−0.79	−0.22	−3.24	.001	−1.27	−0.31		
Gender	0.15	0.04	0.52	.61	−0.43	0.73		
Step 2							0.04	0.01
Social E-cig	0.98	0.19	2.79	**.006**	0.29	1.67		
Regular E-cig	0.38	0.09	1.29	.20	−0.20	0.96		

Note. Non e-cig users are the reference group. Bolded p-values are significant after correcting for multiple comparisons (Holm, 1979).

Table 5

Hierarchical logistic regression examining the relationship between former smokers and hazardous alcohol consumption

		B	Wald	p	Exp(*B*)
Step 1	**Model 1**				
	White	0.003	<.001	.99	1.003
	Age	−0.04	3.85	.05	0.96
	Gender	0.50	1.51	.22	1.64
	Former Smoker	0.39	0.98	.32	1.48
Step 2	E-cig Status				
	Model 2				
	White	0.14	0.07	.79	1.14
	Gender	0.48	1.33	.25	1.61
	Age	−0.04	3.29	.07	0.96
Step 2	Social E-cig User	1.17	5.95	**.01**	3.21
	Regular E-cig User	−0.37	0.46	.50	0.69

Note. Model 1 examines the relationship between former smokers that either do or do not (reference group) currently use an e-cig and hazardous alcohol use. Model 2 examines the relationship between non e-cig users (reference group), social e-cig users, and regular e-cig users and hazardous alcohol consumption. Non-hazardous alcohol users are the reference group for both models. Bolded p-values are significant after correcting for multiple comparisons (Holm, 1979).